THE CLAIMS

WHAT IS CLAIMED IS:

1. A patient sensor for use in monitoring a patient who is at risk of developing decubitus ulcers, said patient sensor having at least a first end and a second end, comprising:

(a) a nonconductive upper member, said upper member having an outer surface and an inner surface,

wherein at least a portion of said upper member inner surface is electrically conductive;

(b) a nonconductive lower member, said lower member having an inner surface and an outer surface, said lower member inner surface being positionable to be proximate to said upper member inner surface,

wherein at least a portion of said lower member inner surface is electrically conductive, said electrically conductive portion of said lower member inner surface containing at least two electrically isolated circuits thereon,

(b1) wherein a first circuit of said at least two electrically isolated circuits contains at least a plurality of spaced apart resistive elements therein, and,

(b2) wherein a second circuit of said at least two electrically isolated circuits, when taken in combination with said first circuit, forms a plurality of switches, each of said switches having at least one of said resistive elements associated

therewith and each of said switches being located at a predetermined distance from said first end of said patient sensor;

(c) a nonconductive central spacer between said upper member and said lower member, said central spacer

electrically separating at least a portion of said upper member and said lower member inner surfaces, and,

allowing at least a portion of said conductive portions of said upper member and said lower member to come into electrical contact when a patient is present on said patient sensor, thereby electrically engaging at least one of said plurality of switches and the resistive elements associated therewith; and,

(d) an electrical line in electrical communication with said conductive portions of said upper and lower members, said electrical line having at least three electrically isolated conductors therein, wherein

(d1) a first conductor of said at least three conductors is in electrical communication with said first circuit,

(d2) a second conductor of said at least three conductors is in electrical communication with said first circuit, such that by measuring the potential between said first and second conductors a total resistance in said first circuit may be determined, and

(d3) a third conductor of said at least three conductors is in electrical communication with said second electrically isolated circuit, such

that by measuring a total resistance between said first circuit and said second circuit a determination may be made of a location and extent of said at least one point of contact.

2. A patient sensor according to Claim **1**, further comprising:

(e) an electronic patient monitor in electrical communication with said patient sensor via said electrical line, said patient monitor at least for determining the patient's position on the sensor and an amount of the patient sensor occluded by the patient.

3. A patient sensor according to Claim **2**, wherein said electronic patient monitor comprises at least:

(e1) a CPU, said CPU being positionable to be in electronic communication with said electrical line and with said first and second circuits,

(e2) a time circuit in electrical communication with said CPU,

(e3) a speaker in electrical communication with said CPU, said speaker being operable under control of said CPU to generate an alarm in response thereto,

(e4) computer memory, said memory in electrical communication with said CPU and at least containing a plurality of computer instructions executable by said CPU, said computer instructions comprising at least the steps of:

(1) determining a first resistive value across said first and second conductors,

(2) determining a second resistive value across said first and third conductors,

(3) determining from said first and second resistive values at least an initial nearest engaged resistive element of said plurality of resistive elements, wherein said nearest engaged resistive element is measured with respect to said first end,

(4) determining from said first and said second resistive values an initial number of said resistive elements that are engaged,

(5) after a period of time has elapsed, determining a third resistive value across said first and second conductors, and, determining a fourth resistive value across said first and said third conductors,

(6) determining from said third and said fourth resistive values a current nearest engaged resistive element of said plurality of resistive elements, wherein said current nearest engaged resistive element is measured within respect to said first end,

(7) determining from said first and second resistive values a current number of said resistive elements that are engaged,

(8) using at least said initial nearest contact point, said current nearest contact point, said initial number of resistive elements that are engaged, and said current number of

resistive elements that are engaged to determine whether the patient has moved during a predetermined period of time,

(9) if the patient has moved during said period of time, performing steps (1) through (8) as necessary to reduce the risk of decubitus ulcers in the patient, and,

(10) if the patient has not moved during said period of time, sounding an alarm at least through said speaker to indicate that the patient has not moved, thereby reducing the risk of decubitus ulcers in the patient.

4. A patient sensor for use in monitoring a patient according to Claim **1**, wherein said resistive elements are resistors.

5. A patient sensor for use in monitoring a patient according to Claim **1**, wherein said resistive elements are resistors all having a same resistance.

6. A patient sensor for use in monitoring a patient according to Claim **3**, wherein said first, second, third, and fourth resistive values are resistances.

7. A patient sensor for use in monitoring a patient according to Claim **3**, wherein said resistive elements are capacitors and said first, second, third, and fourth resistive values are capacitances.

8. A patient sensor for use in monitoring a patient according to Claim **1** wherein said first circuit contains a plurality of linearly spaced apart resistive elements connected together serially.

9. A patient sensor for use in monitoring a patient according to Claim **1** wherein said first circuit contains a plurality of linearly spaced apart resistive elements connected together in parallel.

10. A patient sensor for use in monitoring a patient according to Claim **1** wherein each of said resistive elements is a thermocouple.

11. A patient sensor for use in monitoring a patient who is at risk of developing decubitus ulcers, said patient sensor having at least a length and a first end and a second end, comprising:

(a) a nonconductive lower member, said lower member having an inner surface and an outer surface,

wherein said lower member inner surface has at least one resistive ladder thereon, said at least one resistive ladder having a plurality of serially connected spaced apart resistive elements spanning at least a portion of said length of said patient sensor, and,

wherein said nonconductive lower member inner surface has an electrically isolated contact circuit proximate to said resistive ladder;

(b) a nonconductive upper member, said upper member having an outer surface and an inner surface,

wherein at least a portion of said upper member inner surface is electrically conductive,

(c) a nonconductive central spacer positionable to be between said upper member and said lower member, said central spacer

separating said electrically conductive portions of said upper member and said lower member, and,

allowing said electrically conductive portions of said upper member and said lower member to come into contact when pressure is applied to said patient sensor, thereby electrically shorting said first circuit and said second circuit at a point of contact when said contact is made; and,

(d) an electrical line in electrical communication with said conductive portions of said upper and lower members, said electrical line having at least three electrically isolated conductors therein, wherein

(d1) a first conductor of said at least three conductors is in electrical communication with said first circuit,

(d2) a second conductor of said at least three conductors is in electrical communication with said first circuit such that by measuring the potential between said first and second conductors a total amount of resistance in said first conductor may be determined, and

(d3) a third conductor of said at least three conductors is in electrical communication with said second electrically isolated circuit.

12. A patient sensor for use in monitoring a patient according to Claim **11**, wherein said resistive elements are resistors.

13. A patient sensor for use in monitoring a patient according to Claim **11**, wherein said resistive elements are resistors having a same resistance.

14. A method of monitoring a patient who is at risk of developing decubitus ulcers, wherein is provided

a patient sensor positionable to be proximate to the patient and being operable to provide at least a proportion of the sensor occluded by the patient and a contact point of the patient on the sensor, and,

a patient turn interval,

comprising the steps of:

(a) determining whether a patient is present on the sensor;

(b) using said patient sensor to determine an initial contact point of the patient on the sensor;

(c) using said patient sensor to determine an initial occluded region of the patient on the sensor;

(d) waiting a period of time;

(e) using said patient sensor to determine a subsequent contact point of the patient on the sensor;

(f) using said patient sensor to determine a subsequent occluded region of the patient on the sensor;

(g) using at least said initial contact point, said initial occluded region, said subsequent contact point, and said subsequent occluded region to determine whether the patient has moved during said period of time;

(h) if the patient has not moved during said period of time, determining a time since the patient last moved;

(i) if said time since the patient last moved exceeds said patient turn interval, sounding an alarm;

(j) if said time since the patient last moved does not exceed said patient turn interval, continuing to perform steps (d) through (i) until either the patient moves again or until the time since the patient last moved exceeds said patient turn; and,

(k) if the patient has moved during said time period, continuing to perform steps (d) through (j) until either the patient moves again or until the patient turn interval is exceeded.

15. A method of monitoring a patient who is at risk of developing decubitus ulcers according to Claim **14**, wherein is said patient sensor contains at least one resistive ladder therein, said at least one resistive ladder being operable to provide at least a

proportion of the sensor occluded by the patient and a contact point of the patient on the sensor.

16. A patient sensor for use in monitoring a patient who is at risk of developing decubitus ulcers, comprising:

(a) a nonconductive upper member, said upper member having an outer surface and an inner surface, at least a portion of said upper member inner surface being electrically conductive;

(b) a nonconductive lower member, said lower member having an inner surface and an outer surface, said lower member inner surface being positionable to be proximate to said upper member inner surface, said upper member and said lower member together defining an interior region of said patient sensor when so positioned,

(c) a first electrical circuit within said interior region of said patient sensor, said first circuit comprising a plurality of spaced apart resistive elements,

(d) a second electrical circuit within said interior region of said patient sensor, wherein,

(d1) said second electrical circuit is electrically isolated from said first electrical circuit, and,

(d2) said conductive portion of said upper member inner surface causes said second electrical circuit to electrically engage said first electrical circuit when said patient sensor is compressed,

(e) a nonconductive central spacer positionable between said upper member and said lower member, said central spacer

electrically separating said upper member and said lower member when so positioned, and,

allowing said second circuit to engage said first circuit when pressure is applied to said patient sensor, thereby electrically shorting said first circuit and said second circuit at at least one point of contact; and,

(f) an electrical line having at least three electrically isolated conductors therein, wherein

(f1) a first conductor of said at least three conductors is in electrical communication with said first circuit,

(f2) a second conductor of said at least three conductors is in electrical communication with said first circuit such that by measuring the potential between said first and second conductors a total amount of resistance in said first conductor may be determined, and

(f3) a third conductor of said at least three conductors is in electrical communication with said second electrically isolated circuit.

17. A patient sensor for use in monitoring a patient according to Claim **16**, wherein said resistive elements are resistors.

18. A patient sensor for use in monitoring a patient according to Claim **16**, wherein said resistive elements are selected from a group consisting of capacitors, diodes, or inductors.

19. A patient sensor for use in monitoring a patient according to Claim **16** wherein said first circuit contains a plurality of linearly spaced apart resistive elements connected together serially.

20. A patient sensor for use in monitoring a patient according to Claim **16** wherein said first circuit contains a plurality of linearly spaced apart resistive elements connected together in parallel.

21. A patient sensor for use in monitoring a patient according to Claim **16**, wherein said electrical line has at least four electrical connectors, and further comprising:

(g) a third electrical circuit within said interior region of said patient sensor, said third electrical circuit

(g1) comprising a plurality of spaced apart resistive elements,

(g2) being electrically isolated from said first electrical circuit and said second electrical circuit, and,

(g3) being in electrical communication with said fourth electrical lead,

(g4) wherein said conductive portion of said upper member inner surface causes said second electrical circuit to electrically engage said first

electrical circuit, or said third electrical circuit, or both when said patient sensor is compressed.

22. A patient sensor for use in monitoring a patient who is at risk of developing decubitus ulcers, wherein said sensor is configured to be positioned beneath the patient, comprising:

(a) a nonconducting upper member, said upper member having a perimeter and an inner surface;

(b) a nonconducting lower member, said lower member having a perimeter and an inner surface, and said lower member being sized to be at least approximately commensurate with said upper member, said upper and lower members being joined together along their perimeters, said upper and lower members taken together forming an interior of said patient sensor therebetween;

(c) a nonconducting central spacer, positioned between said upper and lower members and separating at least a portion of upper member inner surface from contact with said lower member inner surface;

(d) a first conductor within said interior of said patient sensor, said first conductor having a first end and a second end, and said first conductor comprising at least a plurality of serially interconnected resistive elements;

(e) a plurality of spaced apart serially connected switches, wherein

(e1) each of said switches engages said first conductor at a predetermined location when activated,

(e2) at least a portion of each of said switches is located on said upper member inner surface and another portion of each of said switches is located on said lower member inner surface, and,

(e3) each of said switches can be separately activated by the patient when said sensor is positioned underneath the patient, each switch being so activated only when it is at least approximately directly beneath the patient; and,

(f) a second conductor in electrical communication with said serially connected switches, said second conductor coming into electrical communication with said first conductor if at least one of said switches is activated in response to a patient's presence on said sensor, whereby

(f1) measuring an electrical property between said second conductor and said first end of said first conductor provides a value representative of an activated switch nearest said first end of said first conductor, and,

(f2) measuring an electrical property between said second conductor and said second end of said first conductor provides a value representative of an activated switch nearest said second end of said first conductor.

23. A method according to Claim **22**, wherein said resistive elements are resistors and said measured electrical properties between said first conductor and said second conductor are resistances.

24. A method according to Claim **22**, wherein said resistive elements are capacitors and said measured electrical properties between said first conductor and said second conductor are capacitances.

25. A patient sensor for use in monitoring a patient according to Claim **23**, wherein said resistive elements are thermocouples and said measured electrical properties between said first conductor and said second conductor are voltages.

26. A patient sensor for use in monitoring a patient according to Claim **22**, wherein said resistive elements are resistors all having a same resistance.

27. A patient sensor for use in monitoring a patient according to Claim **22**, further comprising:

(g) a calibration resistive element in electrical communication with said second conductor, said calibration resistive element having a nominal resistive value and being separately measurable to determine an actual resistive value, said actual resistive value at least for use in scaling said first circuit resistive elements.

28. A patient sensor for use in monitoring a patient according to Claim **22**, further comprising:

(g) an electronic patient monitor in electronic communication with said sensor, said electronic patient monitor at least for

(g1) determining a position of the patient on the sensor and an amount of said sensor occluded by the patient,

(g2) determining a time since the patient last moved, and,

(g3) generating an alarm signal at least if said time since the patient last moved exceeds a predetermined time value.

29. A patient sensor for use in monitoring a patient who is at risk of developing decubitus ulcers, said sensor at least for providing a patient's position and an amount of said sensor occluded by the patient's presence thereon, said patient sensor being positionable to be placed beneath the patient, comprising:

(a) a nonconductive upper member, said upper member having an outer surface and an inner surface,

(b) a nonconductive lower member, said lower member having an inner surface and an outer surface, said lower member inner surface being positionable to be proximate to said upper member inner surface, said upper member and lower member together forming an interior of said sensor,

wherein at least a portion of said lower member inner surface is electrically conductive, said electrically conductive portion of said lower member inner surface comprising at least a plurality of resistive elements connected in parallel by at least one conductor,

said plurality of resistive elements and said at least one conductor comprising a resistive circuit;

(c) a plurality of spaced apart switches within said interior of said sensor,

(c1) wherein each of said switches is positioned at a predetermined location within the sensor,

(c2) wherein at least a portion of each switch is on said upper member inner surface;

(c3) wherein at least a portion of said switches engage a matching number of said resistive elements when the sensor is positioned beneath the patient, and,

(c4) wherein each of said plurality of switches is separately readable to determine which of said switches is engaged, thereby providing information related to said position of the patient and said amount of said sensor occluded by the patient; and,

(c) a nonconductive central spacer between said upper member and said lower member, said central spacer

electrically separating at least a portion of said upper member and said lower member inner surfaces when said sensor is not beneath the patient, and,

allowing at least a portion of said conductive portions of said upper member and said lower member to come into electrical contact when a patient is present on said patient sensor, thereby electrically

engaging at least one of said plurality of switches and the resistive elements associated therewith, and,

(d) a plurality of electrical lines in electrical communication with said plurality of switches, wherein,

(d1) each of said electrical lines is electrically isolated from the other,

(d2) each of said electrical lines is in electrical communication with a different one of said plurality of switches, and,

(d2) measuring an electrical property between any of said electrical lines and said resistive circuit provides a signal indicative of whether said associated switch is engaged.

30. A method according to Claim **29**, wherein said resistive elements are resistors and said measured electrical property between any of said electrical lines and said resistive circuit is a resistance.

31. A method according to Claim **29**, wherein said resistive elements are capacitors and said measured electrical property between any of said electrical lines and said resistive circuit is a capacitance.

32. A patient sensor for use in monitoring a patient according to Claim **29**, wherein said resistive elements are thermocouples and said measured electrical property between any of said electrical lines and said resistive circuit is a voltage.

33. A patient sensor for use in monitoring a patient according to Claim **30**, wherein said resistive elements are resistors all having a same resistance.

34. A patient sensor for use in monitoring a patient according to Claim **29**, further comprising:

(e) an electronic patient monitor in electrical communication with said patient sensor and with said plurality of electrical, said electronic patient monitor at least for determining an approximate location of the patient from any switch engagements.

35. A patient sensor for use in monitoring a patient according to Claim **34**, wherein said electronic patient monitor contains a microprocessor therein, said microprocessor programmed to perform the steps of at least determining an approximate location of the patient from any switch engagements.

36. A method of calibrating patient sensor, said patient sensor at least for use in sensing an amount of said sensor occluded by a patient and said patient sensor at least containing a resistive ladder therein, said resistive ladder being comprised of at least two resistive elements, each of said at least two resistive elements having a nominal resistive value associated therewith, and wherein is further provided a calibration resistive element within said patient sensor, said calibration resistive element having a nominal resistive value representative of said resistive values of said at least two resistive elements, said method comprising the steps of:

(a) measuring a total resistance of all of said at least two resistive elements;

(b) measuring a resistance of said calibration resistive element;

(c) adjusting said measured total resistance based on said measured resistance of said calibration resistive element;

(d) using at least said adjusted measured total resistance to determine an amount of said sensor occluded by the patient.

37. A method of calibrating a resistive ladder according to Claim **36**, wherein each of said at least two resistive elements and said calibration resistive element have a same nominal resistance.

38. A method of calibrating a resistive ladder according to Claim **37**, wherein step (c) comprises the step of:

(c1) dividing said measured total resistance by said measured resistance of said calibration resistive element, thereby adjusting said measured total resistance.

39. A patient sensor for use in monitoring a patient, said sensor at least for providing a patient's position and an amount of said sensor occluded by the patient's presence thereon, said patient sensor being positionable to be placed beneath the patient, said patient sensor having an interior, comprising:

(a) a resistive ladder within said patient sensor, said resistive ladder containing a plurality of resistive elements therein, each of said resistive elements having a nominal resistive value associated therewith;

(b) a plurality of switches, each of said switches engaging one of said resistive elements when said switch is placed beneath the patient, each of said switches being located at a predetermined location within said sensor interior; and,

(c) first, second, and third leads in communication with said resistive ladder, whereby,

(c1) said first and second leads taken together provide a signal at least representative of a distance of the patient from an end of said sensor, and,

(c2) said first and third leads taken together provide a signal at least representative of an amount of said sensor occluded by the patient's presence thereon.

40. A patient sensor according to Claim **39**, wherein said first, second, and third leads are electrical leads and said resistive elements are selected from a group consisting of consisting of electrical resistors, capacitors, diodes, or inductors

41. A patient sensor according to Claim **39**, wherein said first, second, and third leads are fiber optic leads and said resistive elements are optical attenuators.

42. A patient sensor according to Claim **39**, further comprising:

(d) a calibration resistive element in communication with said resistive ladder, said calibration resistive element having a nominal resistive value representative of said nominal resistive values of said resistive elements in said resistive ladder.

43. A patient sensor according to Claim **39**, further comprising:

(d) an electronic patient monitor in communication with said patient sensor, said electronic patient monitor at least for reading said plurality of signals and determining therefrom said patient position and said amount of said sensor occluded by the patient.

44. A patient sensor according to Claim **39**, wherein each of said nominal resistive values of said resistive elements is a same value.